CLAIMS

Having thus described the aforementioned invention, we claim:

1. An optical device in which an optical element is adhered to a support member, said optical device comprising:

a first member;

a second member defining an aperture for receiving said first member, said second member having a pair of openings diametrically opposed relative to said first member in said opening, each of said pair of openings having a passage from an outside surface of said second member to said aperture; and

an adhesive disposed within said pair of openings, said adhesive adhering to said first member and to an inside surface of said pair of openings, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first member and said second member.

2. The optical device of Claim 1 wherein said adhesive is limited to a volume bounded by said pair of slots and a surface of said first member.

3. The optical device of Claim 1 wherein said adhesive is an epoxy with a filler.

4. The optical device of Claim 1 wherein said adhesive is an epoxy with a filler having a concentration of at least 68%, said filler being amorphous silica.

5. The optical device of Claim 1 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

6. The optical device of Claim 1 wherein said adhesive has no more than 0.1 % shrinkage during curing.

7. The optical device of Claim 1 wherein said adhesive has no more than 100 ppm per degree Celsius of thermal expansion over a temperature range from -40 degrees Celsius to +85 degrees Celsius.

8. The optical device of Claim 1 wherein said first member is an optical element selected from a group including a collimator, an actuator, an attenuator, and an optical filter.

9. The optical device of Claim 1 wherein said second member is an optical element selected from a group including a collimator, an actuator, an attenuator, and an optical filter.

10. The optical device of Claim 1 wherein each of said pair of openings has a longitudinal axis parallel to a longitudinal axis of said first member.

11. The optical device of Claim 1 further including:

a third member;

a second aperture in said second member, said second member having a second pair of openings diametrically opposed relative to said third member in said second aperture, said second pair of openings having a passage from an outside surface of said second member to said second aperture, each of said second pair of openings having a longitudinal axis parallel to a longitudinal axis of said third member; and

said adhesive disposed within said second pair of openings, said adhesive adhering to said third member and to an inside surface of said second pair of openings, said adhesive having a viscosity sufficiently high that said adhesive, in

an uncured state, does not substantially wick between said third member and said second member.

12. An optical device in which an optical element is adhered to a support member, said optical device comprising:

a first member;

a second member defining an opening for receiving said first member, said second member having a pair of slots diametrically opposed relative to said first member in said opening, each of said pair of slots having a passage from an outside surface of said second member to said opening, each of said pair of slots having a longitudinal axis parallel to a longitudinal axis of said first member; and

an adhesive disposed within said pair of slots, said adhesive adhering to said first member and to an inside surface of said pair of slots, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first member and said second member, said adhesive including an epoxy and a filler, said filler being amorphous silica, said filler having a concentration of at least 68 percent and having an average particle size less than or equal to 10 micrometers.

13. An optical device in which a plurality of optical elements are adhered to a support member, said optical device for acting on optical signals, said optical device comprising:

a first collimator;

a second collimator;

an actuator;

a housing defining two openings for receiving said first and second collimators, said housing defining an actuator opening for receiving said actuator, said actuator opening substantially between about said two openings, said first

collimator positioned such that a light beam is directed into said second collimator through at least one mirror, said actuator positioned such that said actuator interacts with said light beam when said actuator is actuated, said housing having a pair of slots for each of said two openings and said actuator opening, said pair of slots diametrically opposed relative to each of said two openings and said actuator opening, each of said pair of slots having a longitudinal axis parallel to a corresponding longitudinal axis of said first and second collimators and said actuator; and

an adhesive disposed within each of said pair of slots, said adhesive adhering to a corresponding said first and second collimator and to an inside surface of each of said pair of slots, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first and second collimators and said housing and between said actuator and said housing.

14. The optical device of Claim 13 wherein said adhesive is limited to a volume bounded by said pair of slots and a surface of said first member.

15. The optical device of Claim 13 wherein said adhesive is an epoxy with a filler, said filler being amorphous silica.

16. The optical device of Claim 13 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

17. The optical device of Claim 13 wherein said adhesive is an epoxy with a filler having a concentration of at least 68%, said filler being amorphous silica.

18. The optical device of Claim 13 wherein said actuator includes an attenuator that interacts with an optical path from said first collimator to said second collimator.

19. The optical device of Claim 13 further including:

a third collimator;

a third collimator opening for receiving said third collimator, said housing having a pair of third collimator slots for said third collimator opening, said pair of third collimator slots diametrically opposed relative to said third collimator opening, said pair of third collimator slots having a longitudinal axis parallel to a corresponding longitudinal axis of said third collimator; and

said adhesive disposed within said pair of third collimator slots, said adhesive adhering to said third collimator and to an inside surface of said pair of third collimator slots, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said third collimator and said housing.

20. The optical device of Claim 19 wherein said actuator includes a mirror which, when interjected into an optical path from said first collimator to said third collimator by said actuator, said optical path is redirected from said first collimator to said second collimator.

21. The optical device of Claim 19 wherein said actuator includes a mirror which, when interjected into a first optical path from said first collimator to said third collimator by said actuator, said first optical path is interrupted and a second optical path is formed from said second collimator to said third collimator.

22. An optical device in which a first element is adhered to a second element, said optical device comprising:

an optical element;

a support member in contact with said optical element, said support member having at least one surface substantially perpendicular with a surface of said optical element; and

an adhesive in contact with said optical element and said at least one surface of said support member, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said optical element and said support member, said adhesive including a filler of amorphous silica.

23. The optical device of Claim 22 wherein said at least one surface of said support member is defined by at least one inside face of an opening in said support member, said opening passing between an inside surface proximal said optical element and an outside surface.

24. The optical device of Claim 22 wherein said adhesive includes a filler of having an average particle size less than or equal to 10 micrometers.

25. An optical device in which a first element is adhered to a second element, said optical device comprising:

an optical element;

a means for supporting said optical element; and

a means for adhering said optical element to said means for supporting.

26. The optical device of Claim 25 wherein said means for adhering includes an adhesive in contact with said optical element and said means for supporting such that said adhesive bridges an area adjacent to where said optical element is proximal said means for supporting.

27. A method for forming an optical device by adhering a first element to a second element such that displacement between the first and second elements is limited, said method comprising the steps of::

a) aligning a first member relative to a second member, said second member adapted to receive said first member, said second member having at least one opening having a passage through which said first member is visible;

b) applying an adhesive to each of said at least one opening, said adhesive adhering to said first member and to an inside surface of each of said at least one opening, said adhesive having a viscosity sufficiently high that said adhesive, in an uncured state, does not substantially wick between said first member and said second member; and

c) curing said adhesive.

28. The method of Claim 27 wherein said at least one opening includes a pair of openings oriented on opposing sides of said first member.

29. The method of Claim 27 wherein said at least one opening has a longitudinal axis parallel to a longitudinal axis of said first member.

30. The method of Claim 27 wherein said adhesive includes a filler of amorphous silica.

31. The method of Claim 27 wherein said adhesive h includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

32. A method for forming an optical device by adhering a first element to a second element such that displacement between the first and second elements is limited, said method comprising the steps of::

a) aligning an optical element relative to a support member;

b) applying an adhesive to a seam proximal said support member joining optical element, said adhesive having a high viscosity such that it does not flow between said optical element and said support member; and

c) curing said adhesive.

33. The method of Claim 32 wherein said support member has a pair of slots oriented on opposing sides of said optical element, said pair of slots adapted to receive said adhesive.

34. The method of Claim 32 wherein said adhesive has a filler and said filler includes amorphous silica.

35. The method of Claim 32 wherein said adhesive includes a filler of amorphous silica having an average particle size less than or equal to 10 micrometers.

36. The method of Claim 32 wherein said adhesive has a filler and said filler includes amorphous silica of at least 68% concentration.